

MS-LS3-2 Heredity: Inheritance and Variation of Traits

California Science Test—Item Content Specifications

# MS-LS3-2 Heredity: Inheritance and Variation of Traits

Students who demonstrate understanding can:

Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.

[Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]

Continue to the next page for the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts.

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Developing and Using ModelsModeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.Develop and use a model to describe phenomena. | LS1.B: Growth and Development of Organisms4. Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. *(secondary to MS-LS3-2)*LS3.A: Inheritance of TraitsVariations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.LS3.B: Variation of Traits4. In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. | Cause and EffectCause and effect relationships may be used to predict phenomena in natural systems. |

## Assessment Targets

Assessment targets describe the focal knowledge, skills, and abilities for a given three-dimensional Performance Expectation. Please refer to the Introduction for a complete description of assessment targets.

### Science and Engineering Subpractice(s)

Please refer to appendix A for a complete list of Science and Engineering Practices (SEP) subpractices. Note that the list in this section is not exhaustive.

2.1 Ability to develop models

2.2 Ability to use models

### Science and Engineering Subpractice Assessment Targets

Please refer to appendix A for a complete list of SEP subpractice assessment targets. Note that the list in this section is not exhaustive.

2.1.1 Ability to determine components of a scientific event, system, or design solution

2.1.2 Ability to determine the relationships among multiple components of a scientific event, system, or design solution

2.1.4 Ability to represent mechanisms, relationships, and connections to illustrate, explain, or predict a scientific event

2.2.1 Ability to use models to identify concepts and relationships represented in the models

2.2.2 Ability to use models to generate explanations and predictions about a scientific phenomenon

### Disciplinary Core Idea Assessment Targets

#### LS1.B.4

* Explain the differences in genetic variation that arise from sexual and asexual reproduction
* Describe that during reproduction parents transfer genetic information in the form of genes to their offspring

#### LS3.A.6

* Describe that variations of inherited traits between parent and offspring arise from the genetic differences in the genes inherited
* Describe why sexual and asexual reproduction result in different types of genetic variation in offspring relative to their parents

#### LS3.B.4

* Describe that in sexually reproducing organisms, the parents typically have two sets of chromosomes
* Describe that in sexual reproduction, each parent contributes a set of chromosomes to the offspring
* Describe how offspring from sexual reproduction reflect a combination of genetic material from both parents and therefore contain new combinations of genes not found in the parents
* Predict the possible or probable genetic makeup of the offspring if parental information is provided

### Crosscutting Concept Assessment Target(s)

CCC2 Use cause and effect relationships to predict phenomena in natural systems

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task presents a model comparing sexual and asexual reproduction in organisms:

* Selects components used to compare the two different types of reproduction (2.1.1, LS1.B.4, and CCC2)
* Explains the transfer of genetic information to offspring via sexual reproduction (2.1.1, LS1.B.4, and CCC2)
* Explains the transfer of genetic information to offspring via asexual reproduction (2.1.1, LS1.B.4, and CCC2)

Task provides students with a representation of sexual or asexual reproduction:

* Uses labels to represent mechanisms of genetic transfer during sexual/asexual reproduction (2.1.3, LS3.A.6, and CCC2)

Task provides a model comparing sexual reproduction and asexual reproduction:

* Analyzes the provided model to identify evidence for relationships in each type of reproduction (2.2.1, LS1.B.4, and CCC2)

Task includes a model (e.g., a Punnett square, a diagram) of sexual reproduction providing the genetic information for two parents:

* Predicts the genetic makeup of the possible offspring resulting from the cross (2.2.2, LS3.B.4, and CCC2)
* Explains how the genetic differences could arise from the subset of chromosomes inherited (2.2.2, LS3.A.6, and CCC2)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Different parental genetics and possible offspring resulting from sexual and asexual reproduction
* Variations of inherited traits in offspring from sexual and asexual reproduction
* Punnett squares or simulations to analyze genetic variation in offspring resulting from sexual reproduction
* Asexual and sexual reproduction in growing crops
* Models of genetic inheritance other than simple dominance

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Sexual reproduction is always advantageous over asexual reproduction.
* Genetic variation in offspring cannot be predicted.
* All organisms reproduce in the same way.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

MS-LS3-2 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/MS-LS3-2 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/MS-LS3-2%20Evidence%20Statements%20June%202015%20asterisks.pdf)

The *2016 Science Framework for California Public Schools Kindergarten through Grade 12*

Appendix 1: Progression of the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts in Kindergarten through Grade 12 <https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix1.pdf>

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